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possessed 12 chromosomes. Therefore in both cases the numbers are the same as in the parents to which they revert in the F_2 . This of course does not eliminate the possibility that a fusion of nuclei had occurred, and that afterward a regulation in the number took place, perhaps just previous to reduction or at the time of reduction.

STRASBURGER¹² has made a number of *Solanum* grafts according to WINKLER's method, and examined the growing tissues along their line of union, to determine whether cell fusions take place. He found no indication that such is the case, but of course negative evidence in such a matter is inconclusive, for the graft hybrids are rare at best. STRASBURGER concludes that WINKLER's cases are really complicated chimeras, in which the tissues of the two parents are intimately blended in the growing points. He proposes to call them "hyperchimeras," and cites various analogous cases of very intimate relationship, such as between parasite and host.

WINKLER, however, is still convinced that these cases are true graft hybrids, although concurring in STRASBURGER's opinion that *Cytisus Adami*, which STRASBURGER¹³ showed to have the same number of chromosomes as its parents, is a chimera. He proposes to determine the chromosome number in the somatic cells of the *Solanum* hybrids to see whether it is higher than in the germ cells, and contends that, even though no fusion of nuclei occurs, in its absence the effect of the cytoplasm of one type of cell upon the other will be necessary to explain the production of the characters of the graft hybrids. This view scarcely seems necessary to explain the present facts, but WINKLER's further cytological papers to determine what actually occurs will be awaited with interest. It is hoped that full accounts, with figures, will be forthcoming.

BAUR¹⁴ has reiterated recently his belief that these forms are explainable as periclinal chimeras, varying in the arrangement of the layers in the growing point, and thinks that the case of *Crataegomespilus* can be explained in the same way.

The fact that in these *Solanums* the number of chromosomes is so unlike adds much to the interest of the situation.—R. R. GATES.

Sexuality of the rusts.—The differences of nuclear behavior in the rusts as described by BLACKMAN and CHRISTMAN have led KURSSANOW¹⁵ to investigate a similar form. According to BLACKMAN,¹⁶ in the caeoma of *Phragmidium violaceum* the nucleus of a vegetative cell passes into that of a specially differentiated female

¹² STRASBURGER, E., Meine Stellungnahme zur Frage der Pfropfbastarde. Ber. Deutsch. Bot. Gesell. 27:511-528. 1909.

¹³ ———, Ueber die Individualität der Chromosomen und die Pfropfhybriden-Frage. Jahrb. Wiss. Bot. 44:482-555. pls. 5-7. fig. 1. 1907.

¹⁴ BAUR, E., Pfropfbastarde, Periklinalchimären, und Hyperchimären. Ber. Deutsch. Bot. Gesell. 27:603-605. 1910.

¹⁵ KURSSANOW, L., Zur Sexualität der Rostpilze. Zeit. Bot. 2:81-93. pl. 1. 1910.

¹⁶ BLACKMAN, V. H., On the fertilization, alternation of generations, and the general cytology of the Uredineae. Annals of Botany 18:323-373. 1904.

cell, which bears an abortive trichogyne-like organ. According to CHRISTMAN,¹⁷ on the other hand, in the caeoma of *Phragmidium speciosum* we have the conjugation of two equally differentiated cells. BLACKMAN, therefore, believes that a heterogamous condition obtains, while CHRISTMAN describes an isogamous one. In the subsequent papers of these two authors this essential difference is still manifest (see BLACKMAN and FRASER,¹⁸ CHRISTMAN¹⁹). In a more recent publication, OLIVE²⁰ compares these differences and takes a middle ground, believing that both BLACKMAN and CHRISTMAN are in particular cases right. In four forms of the same caeoma type as *Phragmidium*, OLIVE finds that the cells conjugate as described by CHRISTMAN, but that one is larger than the other, that is, a male and a female cell conjugate, the male cell lying a little below the female, which is always surmounted by a trichogyne-like abortive cell, while the male cell has no such abortive portion. During conjugation a broad opening may be present between the two cells, allowing the protoplasmic contents to mix, as described by CHRISTMAN, or only a narrow opening between the two cells may be present, so that only the nuclei of the male cells pass into the female cells, a condition which OLIVE believes to agree with BLACKMAN's description. The two phenomena may be observed in the same plant. OLIVE thus seeks to harmonize the views of BLACKMAN and CHRISTMAN.

KURSSANOW has investigated a caeoma, which he found growing on *Rubus saxatilis* near Moscow, and which he regards as the same or a very similar form to the caeoma studied by CHRISTMAN. He regards CHRISTMAN's studies as too brief to be conclusive, and endeavors to extend the observations. The cells of the vegetative hyphae and haustoria are uninucleate, the nuclei being comparatively large and distinct. Numerous spermatogonia are present on both surfaces of the leaves, whose origin and development are described, with the result that the cells are always uninucleate. The caeomas appear only on the under sides of the leaves. The formation of a sort of palisade arrangement of uninucleate large terminal cells as described by CHRISTMAN is also described by KURSSANOW. There is a conjugation in pairs of these cells, which he regards as equal in size. There is no condition found which could be made to agree with OLIVE's description, but his account is in complete harmony with CHRISTMAN's results. The differences in the methods of conjugation as described by BLACKMAN, CHRISTMAN, and OLIVE, this author believes may be due to differences in the forms investigated

¹⁷ CHRISTMAN, A. H., Sexual reproduction in the rusts. BOT. GAZETTE 39:267-274. 1905.

¹⁸ BLACKMAN, V. H., AND FRAZER, MISS H. C. I., Further studies on the sexuality of the Uredineae. Annals of Botany 20:35-48. 1906.

¹⁹ CHRISTMAN, A. H., The nature and development of the primary uredospore. Trans. Wis. Acad. Sci. 25:517-526. 1907; Alternation of generations and the morphology of the spore forms in the rusts. BOT. GAZETTE 44:81-101. 1907.

²⁰ OLIVE, E. W., Sexual cell fusions and vegetative nuclear divisions in the rusts. Annals of Botany 22:331-360. 1908.

or to a pathological nuclear migration, as suggested by CHRISTMAN, which KURSSANOW has often observed accompanying the normal sexual process. He believes the sterile cells, which are equally well formed on all of the fertile ones, are not to be regarded as trichogynes. They appear to act only as buffers between the epidermis and the fertile cells. He strongly doubts any connection or direct relationship of the rusts to the red algae.—J. B. OVERTON.

Animal ecology.—It is pleasant to note greatly increased activity along ecological lines on the part of zoologists. Contributions that should have been noticed here long since are found in papers by SHELFORD, RUTHVEN, and HANKINSON. SHELFORD²¹ has considered the relation of tiger beetles to plant succession, and has found that there is quite a definite a succession of forms, when the physiography changes, as has been recorded for plants. For example, certain species of *Cicindela* characterize the beach of the dune region near Chicago, while others take their place as the dunes develop, and still others as the dunes become established. Similar succession stages are given for depressions. No species seems to be fitted for life in the climax mesophytic forest of the region.

RUTHVEN,²² after presenting the environmental features of certain regions of New Mexico and Arizona together with full descriptions of the animals collected, gives an exceedingly interesting summary. It is concluded "that each set of environmental conditions which is marked out by a distinct plant association has a definite reptile fauna," and that the sharpest line between the animal associations is that corresponding to the line between the pinyon-cedar association and the more arid treeless associations. It is also noted that continued denudation may be expected to result in the increased development of the arid associations. Plant ecologists, who as a class have long recognized the fundamental errors in MERRIAM's zonal classification as applied to plants, will be interested in observing RUTHVEN's conclusion, based on reptiles and amphibians, that "it seems advisable not to stretch any one zone over the entire continent." The paper is illustrated by a number of halftones showing characteristic animals and habitats.

HANKINSON²³ has given a detailed account of a biological survey of a small Michigan lake. Following an account by DAVIS on the physiography and geology of the region, HANKINSON gives a detailed statement concerning the various field stations and their characteristics, nine kinds of habitats being recognized between the shore and deep water. After an ecological account of the fish fauna by HANKINSON, DAVIS treats of the flora and its ecological features, giving a list of the

²¹ SHELFORD, V. E., Preliminary note on the distribution of the tiger beetles (*Cicindela*) and its relation to plant succession. *Biol. Bull.* **14**:9-14. 1907.

²² RUTHVEN, A. G., A collection of reptiles and amphibians from southern New Mexico and Arizona. *Bull. Amer. Mus. Nat. Hist.* **23**:483-604. 1907.

²³ HANKINSON, T. L., A biological survey of Walnut Lake, Michigan, with chapters on the physiography, geology, and flora of the region by CHARLES A. DAVIS, and a paper on the aquatic insects of the lake by JAMES G. NEEDHAM. *Rep. Mich. Geol. Surv.* **1907**:157-288. 1908.